

2009 INTERNATIONAL ENERGY CONSERVATION CODE HOUSTON AMENDMENTS

FOR THE RESIDENTIAL PORTIONS OF THE CODE



CITY OF HOUSTON
PUBLIC WORKS AND ENGINEERING DEPARTMENT

Effective Jan. 6, 2012

Revised (Section 110) Feb. 1, 2013

USER'S NOTE: This document contains the City of Houston amendments to the adopted code. This document is to be used in addition to the 2009 IECC published by the International Code Council www.iccsafe.org.

Residential structures as defined by the IECC shall comply with this code. Chapter 11 of the adopted 2006 International Residential Code will be amended to reference the 2009 IECC residential provisions.

CHAPTER 1

ADMINISTRATION

101.1 Title. This code shall be known as the ~~*International-City of Houston Residential Energy Conservation Code*~~ of [NAME OF JURISDICTION], and shall, may be cited as such. ~~It is, and will be referred to herein as “this code.”~~ The City of Houston Construction Code collectively includes this volume and certain other codes, pamphlets, specifications, and documents that are adopted in or by reference to the Adopting Ordinance, City of Houston Ordinance No. 2010-847.

101.2 Scope. This code applies to *residential* and ~~commercial~~ buildings.

101.4.2 Historic buildings. Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, ~~are exempt from~~ shall comply with all of the provisions of this code.

Exception: Whenever a provision or provisions would invalidate or jeopardize the historical designation or listing, the building or structure may be exempted from the provision or provisions.

101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. Alterations that replace less than 50 percent of the luminaires in a space, provided that only those luminaires that are replaced need comply with this code ~~such alterations do not increase the installed interior lighting power.~~

8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

101.4.6 Mixed occupancy. Where a building includes both *residential* and *commercial* occupancies, each occupancy shall be separately considered and meet the applicable provisions of Chapter 4 of this code for *residential* and ~~Chapter 5~~ the City of Houston Commercial Energy Conservation Code for *commercial*.

101.5 Compliance. *Residential buildings* shall meet the provisions of Chapter 4. *Commercial buildings* shall meet the provisions of the City of Houston Commercial Energy Conservation Code ~~Chapter 5~~.

SECTION 103

CONSTRUCTION DOCUMENTS PERMITS

103.1 Administrative requirements. Administrative requirements relating to permit requirements, enforcement by the *code official*, locally adopted energy standards, interpretations, claims of exemption, revocation and rights of appeal shall be as set forth in the applicable volume of the City of Houston Construction Code. ~~**General.** Construction documents and other supporting data shall be submitted in one or more sets with each application for a permit. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the *code official* is authorized to require necessary construction documents to be prepared by a registered design professional.~~

~~**Exception:** The *code official* is authorized to waive the requirements for construction documents or other supporting data if the *code official* determines they are not necessary to confirm compliance with this code.~~

103.2 Construction documents. ~~**Information on construction documents.** Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when approved by the *code official*.~~ Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. ~~Details shall include, but are not limited to, as applicable, insulation materials and their *R* values; fenestration *U* factors and SHGCs; area weighted *U* factor and SHGC calculations; mechanical system design criteria; mechanical and service water heating system and equipment types, sizes and efficiencies; economizer description; equipment and systems controls; fan motor horsepower (hp) and controls; duct sealing, duct and pipe insulation and location; lighting fixture schedule with wattage and control narrative; and air sealing details.~~

103.3 Supplemental information. Supplemental information necessary to verify compliance with this code, such as calculations, worksheets, compliance forms, vendor literature, or other data, shall be made available when required by the *code official*. ~~**Examination of documents.** The *code official* shall examine or cause to be examined the accompanying construction documents and shall ascertain whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances.~~

~~**103.3.1 Approval of construction documents.** When the *code official* issues a permit where construction documents are required, the construction documents shall be endorsed in writing and stamped "Reviewed for Code Compliance." Such *approved* construction documents shall not be changed, modified or altered without authorization from the *code official*. Work shall be done in accordance with the *approved* construction documents.~~

~~One set of construction documents so reviewed shall be retained by the *code official*. The other set shall be returned to the applicant, kept at the site of work and shall be open to inspection by the *code official* or a duly authorized representative.~~

~~**103.3.2 Previous approvals.** This code shall not require changes in the construction documents, construction or designated occupancy of a structure for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.~~

~~**103.3.3 Phased approval.** The *code official* shall have the authority to issue a permit for the construction of part of an energy conservation system before the construction documents for the entire system have been submitted or *approved*, provided adequate information and detailed statements have been filed complying with all pertinent requirements of this code. The holders of such permit shall proceed at their own risk without assurance that the permit for the entire energy conservation system will be granted.~~

~~**103.4 Amended construction documents.** Changes made during construction that are not in compliance with the *approved* construction documents shall be resubmitted for approval as an amended set of construction documents.~~

~~**103.5 Retention of construction documents.** One set of *approved* construction documents shall be retained by the *code official* for a period of not less than 180 days from date of completion of the permitted work, or as required by state or local laws.~~

~~**104.3 Final inspection.** The building shall have a final inspection and not be occupied until *approved*.~~

~~**104.8.1 Revocation.** The *code official* is authorized to, in writing, suspend or revoke a notice of approval issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure, premise, or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.~~

SECTION 105

VALIDITY RESERVED

~~**105.1 General.** If a portion of this code is held to be illegal or void, such a decision shall not affect the validity of the remainder of this code.~~

~~**106.4 Other laws.** The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.~~

~~**107.1 Fees.** Fees shall be as set forth in the Houston Building Code. A permit shall not be issued until the fees prescribed in Section 107.2 have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.~~

~~**107.2 Schedule of permit fees.** A fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.~~

~~107.3 Work commencing before permit issuance.~~ Any person who commences any work before obtaining the necessary permits shall be subject to an additional fee established by the *code official*, which shall be in addition to the required permit fees.

~~107.4 Related fees.~~ The payment of the fee for the construction, *alteration*, removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

~~107.5 Refunds.~~ The *code official* is authorized to establish a refund policy.

108.1 Authority. Whenever the *code official* finds any work regulated by this code being performed in a manner either contrary to the provisions of this code or in a dangerous or unsafe manner, the *code official* is authorized to issue a stop work order.

108.2 Issuance. The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work will be permitted to resume.

At the time such a stop work order is issued, the person doing the work and the permit holder shall be given notice of a right to a hearing on the matter pursuant to Section 109. The notice shall be delivered to persons performing the work if present at the site or otherwise shall be conspicuously posted at the site. Upon request, such a hearing shall be held within three business days unless the permit holder or person who was doing the work requests an extension of time. Any stop work order that has been issued shall remain in effect pending any hearing that has been requested unless the stop work order is withdrawn by the code official.

108.4 Failure to comply. Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be ~~liable to a fine of not less than [AMOUNT] dollars or more than [AMOUNT] dollars~~ subject to penalties as prescribed by the City of Houston Building Code.

SECTION 109 **BOARD OF APPEALS HEARING PROCEDURES**

~~109.1 General.~~ In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The *code official* shall be an ex officio member of said board but shall have no vote on any matter before the board. The board of appeals shall be appointed by the governing body and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business, and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official*.

~~109.2 Limitations on authority.~~ An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The board shall have no authority to waive requirements of this code.

~~109.3 Qualifications.~~ The board of appeals shall consist of members who are qualified by experience and training and are not employees of the jurisdiction. **Hearing notice.** Whenever notice is to be given to any person concerning the right to a hearing, the notice may be given by personal delivery or by certified mail, return receipt requested.

If notice is being given to a building owner or to a tenant therein and the code official is unable to determine the name or address of such person after checking the building and the applicable records of the jurisdiction's Public Works and Engineering Department, the County Appraisal District, the electrical utility company, the gas utility company, and the water utility provider, notice shall be mailed to the billing addresses of the building as shown on the records of the electrical company and the gas company and shall be posted on or in view of each entrance to the building. Additionally, if any notice is mailed to a building owner or a building tenant and is returned without delivery, notice shall be effective if posted on or in view of each entrance to the building.

109.2 Hearings. Except where otherwise specifically provided, all hearings held pursuant to this code shall be conducted by the jurisdiction's Director of Public Works and Engineering or a representative, who shall hereinafter be referred to as the "hearing official." The director shall not designate any person to be a hearing official under this code who has taken any part in the investigation of the matter that is the subject of the hearing or any person who directly supervised the investigation. The hearing official shall consider only the evidence presented at the hearing in rendering a decision. The decision of the hearing official shall be set forth in writing and shall be served on each party in the same manner as a notice of a right to a hearing.

SECTION 110 **INCREASED STANDARDS**

110.1 General. For any permit application filed under this code, compliance with additional performance objectives for new construction shall be required to achieve a minimum ten percent improvement in efficiency above the minimum provisions of this code.

110.2 Energy use. New residences and apartments must use 10 percent less energy as shown by one of the methods indicated in Sections 110.2.1, 110.2.2 and 110.2.3.

110.2.1 Energy Star. The United States Environmental Protection Agency's ENERGY STAR Program certification of energy code equivalency; or

110.2.2 Software and testing. Energy code compliance modeling through Texas A&M Energy Systems Laboratory approved software; along with testing of the building thermal envelope for infiltration and the duct system for leakage; or

110.2.3 Option packages. Prescriptive option packages approved by Texas A&M Energy Systems Laboratory and listed in Table 110(1), Table 110(2), or Table 110(3) or subsequently approved by Texas A&M Energy Systems Laboratory and accepted and published by the code official.

TABLE 110(1)
COMBINED ENERGY SAVINGS FOR ONE AND TWO FAMILY STRUCTURES
WITH NATURAL GAS HEATING

<u>Groups</u>	<u>Measures</u>	<u>Notes</u>
<u>Group 1</u>	<u>•Photovoltaic Array for Partial Demand at 2kW</u>	<u>2</u>
<u>Group 2</u>	<u>• Decreased Duct Leakage (maximum 4.8 cfm /100 sq. ft.)</u>	<u>5</u>
	<u>• Decreased Infiltration 5 ACH50</u>	<u>8</u>
	<u>• Improved SEER (minimum 15)</u>	<u>10</u>
	<u>•Improved Furnace Efficiency (minimum .93AFUE)</u>	<u>12</u>

TABLE 110(2)
COMBINED ENERGY SAVINGS FOR MULTI-FAMILY STRUCTURES
WITH NATURAL GAS HEATING

<u>Groups</u>	<u>Measures</u>	<u>Notes</u>
<u>Group 1</u>	• Solar Domestic Hot Water System (21 sq. ft. collector area/unit)	<u>1</u>
<u>Group 2</u>	• Photovoltaic Array for 2kW/unit	<u>2</u>
<u>Group 3</u>	• 75% Energy Star CFL/LED Indoor Lamps • Tankless water heater (minimum .748 Energy Factor) • Decreased Infiltration 5 ACH50	<u>4</u> <u>6</u> <u>8</u>
<u>Group 4</u>	• 75% Energy Star CFL/LED Indoor Lamps • Decreased Duct Leakage (maximum 4.8 cfm /100 sq. ft.) <i>Upper Floor Only</i> • Tankless water heater (minimum .748 Energy Factor) • Decreased U-Factor (maximum .35)	<u>4</u> <u>5</u> <u>6</u> <u>11</u>

TABLE 110(3)
COMBINED ENERGY SAVINGS FOR MULTI-FAMILY STRUCTURES
WITH ELECTRIC HEATING

<u>Groups</u>	<u>Measures</u>	<u>Notes</u>
<u>Group 1</u>	Photovoltaic Array for 2kW/Unit	<u>2</u>
<u>Group 2</u>	• Mechanical Systems within Conditioned Spaces <i>Upper Floor Only</i> • 75% Energy Star CFL/LED Indoor Lamps • Decreased Infiltration 5 ACH50 • Improved SEER (minimum 14) • Decreased U-Factor (maximum .35)	<u>3</u> <u>4</u> <u>8</u> <u>9</u> <u>11</u>
<u>Group 3</u>	• 75% Energy Star CFL/LED Indoor Lamps • Decreased Duct Leakage (maximum 4.8 cfm /100 sq. ft.) <i>Upper Floor Only</i> • Tankless water heater (minimum .98 Energy Factor) • Decreased Infiltration 5 ACH50 • Improved SEER (minimum 14) • Decreased U-Factor (maximum .35)	<u>4</u> <u>5</u> <u>7</u> <u>8</u> <u>9</u> <u>11</u>
<u>Group 4</u>	• 75% Energy Star CFL/LED Indoor Lamps • Decreased Duct Leakage (maximum 4.8 cfm /100 sq. ft.) <i>Upper Floor Only</i> • Decreased Infiltration 5 ACH50 • Improved SEER (minimum 14) • Decreased U-Factor (maximum .35)	<u>4</u> <u>5</u> <u>8</u> <u>9</u> <u>11</u>

Notes:

1. Solar Domestic Hot Water System: *Storage tank type 30 gallon DHW heater with 21 square feet collector area.*
2. Photovoltaic Array for Partial Demand at 2kW: *Equivalent to 10 panels at 205 watts each at minimum 16% efficiency.*
3. Mechanical Systems within Conditioned Spaces: *Ducts in ventilated attic moved to a location within the thermal envelope of conditioned space including unventilated attic space*
4. 75% Energy Star CFL/LED Indoor Lamps: *Permanent Compact Florescent or LED fixtures excluding closets*
5. Decreased Leakage (from 8cfm / 100 sq. ft. to 4.8 cfm / 100 sq. ft.): *Ducts tested with less than 4.8 cfm leakage to outside per 100 sq. ft. of conditioned floor area*
6. Tankless water heater (from .54 to .748 Energy Factor for Electric/Gas house) *Manufacturer's rating*
7. Tankless water heater (from .54 to .98 Energy factor for Electric Multi-family) *Manufacturer's rating*
8. Decreased Infiltration (from 7 ACH to 5 ACH): *tested with a blower door at a pressure of 33.5 psf (50 Pa).*

- 9. Improved SEER (from 13 to 14): *Manufacturer's rating*
- 10. Improved SEER (from 13 to 15): *Manufacturer's rating*
- 11. Decreased U-factor (from .65 to .35): *NFRC 100 and 200*
- 12. Improved Furnace Efficiency (from .78 to .93 AFUE): *Manufacturer's rating*

CHAPTER 2

DEFINITIONS

201.3 Terms defined in other codes. Terms that are not defined in this code but are defined in any volume of the ~~International Building Code, International Fire Code, International Fuel Gas Code, International Mechanical Code, International Plumbing Code or the International Residential Code~~ City of Houston Construction Code shall have the meanings ascribed to them in those codes.

201.5 International code reference. When one of the International Codes is referenced in this document, the reference shall be construed to mean the corresponding City of Houston adopted code.

SECTION 202*

GENERAL DEFINITIONS

ABOVE-GRADEWALL. A wall more than 50 percent above grade and enclosing *conditioned space* that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

ACCESSIBLE. ~~Admitting close approach as a result of not being guarded by locked doors, elevation or other effective means (see “Readily accessible”).~~ Having access to but which first may require the removal of an access panel, door, or similar obstruction covering the item described.

BOILER. A closed vessel used for heating water or liquid, or for generating steam or vapor by direct application of heat from combustible fuels or electricity.

DUCT. ~~A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.~~ Any tube or conduit for transmission of air. This definition shall not include:

1. A vent, a vent connector or a chimney connector.
2. Any tube or conduit wherein the pressure of the air exceeds one (1) pound per square inch.
3. The air passages of listed self-contained systems.

GLAZING AREA. Total area of the glazed fenestration measured using the rough opening and including sash, curbing or other framing elements that enclose conditioned space. Glazing area includes the area of glazed fenestration assemblies in walls bounding conditioned basements. For doors where the daylight opening area is less than 50 percent of the door area, the glazing area is the daylight opening area. For all other doors, the glazing area is the rough opening for the door including the door and frame.

JURISDICTION. The City of Houston, Texas.

PROCESS ENERGY. Energy consumed in support of a manufacturing, industrial, or commercial process other than conditioning spaces and maintaining comfort for the human occupants of a building.

READILY ACCESSIBLE. Capable of being reached quickly for operation, ~~renewal~~ repair or inspection without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to the use of portable ladders or access equipment (see “*Accessible*”).

***{EDITORIAL NOTE: ALL OTHER PORTIONS OF SECTION 202 REMAIN AS SET FORTH IN THE 2009 INTERNATIONAL ENERGY CONSERVATION CODE.}**

CHAPTER 3

CLIMATE ZONES

301.1 General. ~~The Climate zones from Figure 301.1 or Table 301.1 shall be used in determining the applicable requirements from Chapters 4 and 5. Locations not in Table 301.1 (outside the United States) shall be assigned a climate zone based on Section 301.3 for this jurisdiction is climate zone 2A.~~

301.2 Warm humid counties. Warm humid counties are identified in Table 301.1 by an asterisk.

301.3 International climate zones. The climate zone for any location outside the United States shall be determined by applying Table 301.3(1) and then Table 301.3(2).

*{EDITORIAL NOTE: DELETE TABLES 301.1 -301.3(2) }

TABLE 302.2
EXTERIOR DESIGN CONDITIONS

<u>CONDITION</u>	<u>VALUE</u>
<u>Winter, Design Dry-bulb (E_F)</u>	<u>28°F</u>
<u>Summer, Design Dry-bulb</u>	<u>96°F</u>
<u>Summer, Design Wet-bulb</u>	<u>80.5°F</u>
<u>Degree days heating (base 65)</u>	<u>1371</u>
<u>Degree days cooling (base 50)</u>	<u>7534</u>
<u>Climate Zone</u>	<u>2A</u>

303.3 Maintenance information. Maintenance instructions shall be furnished for equipment and systems that require preventive maintenance. Required regular maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.

TABLE 303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC

<u>SINGLE GLAZED</u>		<u>DOUBLE GLAZED</u>		<u>GLAZED BLOCK</u>
<u>Clear</u>	<u>Tinted</u>	<u>Clear</u>	<u>Tinted</u>	
<u>0.8-0.85</u>	<u>0.7</u>	<u>0.7</u>	<u>0.6</u>	<u>0.6</u>

CHAPTER 4

RESIDENTIAL ENERGY EFFICIENCY

402.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of either Table 402.1.1(1) when the total percentage of glazing is less than or equal to 18% of the conditioned floor area or Table 402.1.1(2) for window to wall area ratios based on the climate zone specified in Chapter 3.

When compliance using Table 402.1.1(1) or 402.1.1(2) is demonstrated with a ceiling R-value of R30 or less, no more than 33% of the total projected ceiling area may be of cathedral type construction (ceiling joist/roof rafter assembly) and the required insulation R-value may be reduced to a minimum of R22 insulation when the remaining ceiling area insulation is increased to R38.

***{EDITORIAL NOTE: REPLACE TABLE 402.1.1 AND FOOTNOTES WITH THE FOLLOWING}**

TABLE 402.1.1(1)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT
(BASED ON WINDOW TO SQUARE FOOTAGE RATIO)^a

<u>CLIMATE ZONE</u>	<u>FENESTRATION U-FACTOR^b</u>	<u>SKYLIGHT^b U-FACTOR</u>	<u>GLAZED FENESTRATION SHGC^b</u>	<u>CEILING R-VALUE</u>	<u>WOOD FRAME WALL R-VALUE</u>	<u>MASS WALL R-VALUE^c</u>	<u>FLOOR VALUE</u>
<u>2</u>	<u>0.65^d</u>	<u>0.75</u>	<u>0.30</u>	<u>30</u>	<u>13</u>	<u>4/6</u>	<u>13</u>

For SI: 1 foot = 304.8mm.

- R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2 x 6 framing cavity such that the *R*-value is reduced by R-1 or more shall be marked with the compressed batt *R*-value in addition to the full thickness *R*-value.
- The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
- The second *R*-value applies when more than half the insulation is on the interior of the mass wall.
- For impact rated fenestration complying with Section R301.2.1.2 of the *International Residential Code* or Section 1608.1.2 of the *International Building Code*, the maximum *U*-factor shall be 0.75 in Zone 2.

TABLE 402.1.1(2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT
(BASED ON WINDOW TO WALL RATIO)^a

<u>Maximum Window to Wall Area Ratio</u>	<u>Fenestration U-Factor</u>	<u>Skylight U-Factor^b</u>	<u>Glazed Fenestration SHGC</u>	<u>Ceiling R-Value^c</u>	<u>Wood Frame Wall R-Value</u>	<u>Floor R-Value</u>	<u>Basement Wall R-Value</u>	<u>Slab R-Value & Depth^d</u>	<u>Crawl Space Wall R-Value</u>
<u>15</u>	<u>0.65</u>	<u>0.65</u>	<u>0.40</u>	<u>30</u>	<u>13</u>	<u>15</u>	<u>5</u>	<u>0</u>	<u>6</u>
<u>20</u>	<u>0.55</u>	<u>0.55</u>	<u>0.40</u>	<u>30</u>	<u>13</u>	<u>15</u>	<u>6</u>	<u>0</u>	<u>6</u>
<u>25</u>	<u>0.51</u>	<u>0.51</u>	<u>0.35</u>	<u>30</u>	<u>13</u>	<u>19</u>	<u>8</u>	<u>0</u>	<u>10</u>
<u>30</u>	<u>0.46</u>	<u>0.46</u>	<u>0.35</u>	<u>38</u>	<u>16</u>	<u>19</u>	<u>8</u>	<u>0</u>	<u>10</u>

For SI: 1 foot = 304.8 mm.

- R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2 x 6 framing cavity such that the *R*-value is reduced by R-1 or more shall be marked with the compressed batt *R*-value in addition to the full thickness *R*-value.
- The fenestration *U*-factor column excludes skylights. The SHGC column applies to glazed fenestration.
- If a roof radiant barrier with an emittance of 0.05 or less as tested in accordance with ASTM C-1371 or ASTM E-408 is used, then the roof/ceiling minimum insulation value shall be R-19.
- R-5 shall be added to the required slab edge R-values for heated slabs.

***{EDITORIAL NOTE: REPLACE TABLE 402.1.3 AND FOOTNOTES WITH THE FOLLOWING}**

**TABLE 402.1.3
EQUIVALENT U-FACTORS^a**

<u>CLIMATE ZONE</u>	<u>FENESTRATION U-FACTOR</u>	<u>SKYLIGHT U-FACTOR</u>	<u>CEILING U-FACTOR</u>	<u>FRAME WALL U-FACTOR</u>	<u>MASS WALL U-FACTOR^b</u>	<u>FLOOR U-FACTOR</u>	<u>BASEMENT WALL U-FACTOR</u>	<u>CRAWL SPACE WALL U-FACTOR^b</u>
<u>2</u>	<u>0.65</u>	<u>0.75</u>	<u>0.035</u>	<u>0.082</u>	<u>0.165</u>	<u>0.064</u>	<u>0.360</u>	<u>0.477</u>

a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior the mass wall U-factors shall be a maximum of 0.14.

402.2.1 Ceiling with attic spaces. When Section 402.1.1 would require R-38 in the ceiling R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. ~~Similarly, R38 shall be deemed to satisfy the requirement for R49 wherever the full height of uncompressed R38 insulation extends over the wall top plate at the eaves.~~ This reduction shall not apply to the U-factor alternative approach in Section 402.1.3 and the total UA alternative in Section 402.1.4.

402.2.3 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment that prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

Exception: Pull down attic stair systems may be reduced to R-5 insulation at the stair access. The insulation shall not interfere with the proper operation of the stair. Non-rigid insulation materials are not allowed. Additional insulation systems that enclose the stair system from above are allowed. Exposed foam plastic must meet the provisions of the Houston Residential Code.

402.4.2.2 Visual inspection option (only allowed for remodels or alterations). Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table 402.4.2, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.

402.4.3 Fireplaces. New wood-burning fireplaces shall have ~~gasketed doors~~ tight fitting flue dampers and outdoor combustion air.

402.5 Maximum fenestration U-factor and SHGC (Mandatory).~~The area-weighted average maximum fenestration U factor permitted using trade-offs from Section 402.1.4 or 405 shall be 0.48 in Zones 4 and 5 and 0.40 in Zones 6 through 8 for vertical fenestration, and 0.75 in Zones 4 through 8 for skylights. The area-weighted average maximum fenestration SHGC permitted using trade-offs from Section 405 in Zones 1 through 3 shall be 0.50~~ 0.40.

403.1.1 Programmable thermostat. Where the primary heating system is a forced-air furnace, at least one thermostat per dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall be capable of being initially ~~be~~ programmed with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C).

403.3 Mechanical system piping insulation (Mandatory). Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-3.

Exception: Refrigerant liquid lines.

404.2 Solar Ready (Mandatory). Conduit not less than 1 ¼ inches shall be installed to provide a pathway from the electric panel to the underside of the roof sufficient to allow future installation of solar equipment.

Exception: New single family homes subject to discount in the building code based on valuation.